

DESCRIPTION

The LBK0504 is a miniaturized, high-efficiency 4 A step-down DC-DC converter from 2.3 V to 5.5 V input range. The LBK0504 integrates both a power management integrated circuit (PMIC) and an inductor into a 2.0 mm × 2.5 mm × 1.1 mm package compatible with standard automated pick-and-place equipment.

The LBK0504 combines a PWM peak-current control synchronous buck architecture with a flexible digital interface. Through I²C, users can program the soft-start, address, and timeout, and monitor protection parameters. These protections include input under-voltage lockout (UVLO), over-temperature protection (OTP), output over-voltage protection (OVP), output under-voltage protection (UVP), and cycle-by-cycle current limit.

The LBK0504 supports multi-phase parallel operation. Up to four phases can be combined to extend the total output current capability to 16 A for scalable power architectures.

Delivering ultra-low output ripple and noise performance, the LBK0504 excels in noise-sensitive applications including optical transceivers, point-of-load converters in computing, 5G small cells, and medical devices.

FEATURES

- Input voltage range: 2.3 V to 5.5 V
- Output voltage range: 0.4 V to 4.9 V¹
- 4 A continuous output current (DC)
- High accuracy trimmed voltage reference
- Ultra low flicker and thermal noise operation
- Superior thermal performance
- Multi-phase capability (up to 4 phases)
- Standalone operation supported
- Mode programmability via feedback pin
- External frequency synchronization
- I²C interface for configuration and status monitoring
- Power good notification via general purpose I/O
- Comprehensive protection features:
 - Input under-voltage lockout (UVLO)
 - Output over-voltage protection (OVP)
 - Output under-voltage protection (UVP)
 - Over-temperature protection (OTP)
 - Short-circuit protection (SCP) with cycle-by-cycle peak-current limit
- Compact package: 2.0 mm × 2.5 mm × 1.1 mm
- RoHS compliant

APPLICATIONS

- Optical transceivers and modules
- Computing point-of-load (PoL) converters
- 5G small cells and telecom infrastructure
- Medical instrumentation and devices
- General purpose low-noise step-down conversion

¹Recommended Maximum $V_{out} = V_{in} - 0.6V$

Typical Application

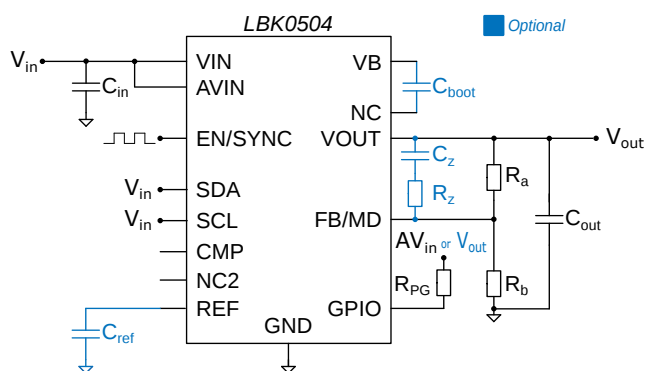


Figure 1: LBK0504 standalone schematic (C_{ref} for ultra low-noise; C_{boot} for improved efficiency).

Efficiency

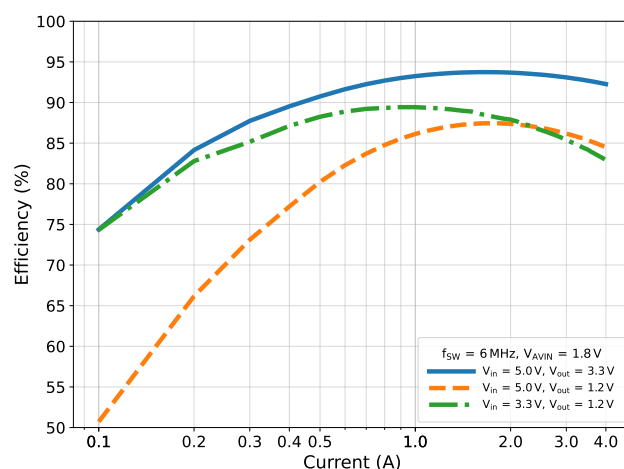


Figure 2: LBK0504 simulated efficiency.

1 Absolute Maximum Rating²

Power Supply Pins

VIN & AVIN to GND -0.3 V to 6.0 V

Output and Switching Pins

VOU to GND & VB to NC -0.3 V to 6.0 V

VB to GND -0.3 V to 12.0 V

NC to GND -0.3 V to (VIN + 0.3 V)

Logic and Control Pins

REF, CMP & FB to GND -0.3 V to 2.1 V

SCL, SDA, GPIO & EN to GND -0.3 V to 6.0 V

NC2 to GND -0.3 V to 7.2 V

Temperature

Operating Temperature Range (TA) -40 °C to 125 °C

Junction Temperature Range (TJ) -40 °C to 150 °C

Maximum Reflow Temperature (T_{pads}) 260 °C

2 Electrical Characteristics³

Parameter	Symbol	Conditions & Notes	Min	Typ	Max	Unit
Output Voltage	V _{out}	Full load	0.4		V _{in} -0.6	V
Output Voltage RMS Noise	V _{out,noise,RMS}	BW = 100 Hz – 100 kHz, V _{out} = 1.2 V, V _{in} = 5 V, C _{ref} = 2.2 μF, C _{out} = 3 × 22 μF		13.5		μV _{RMS}
Power Supply Rejection Ratio	PSRR	f = 1 Hz – 100 kHz, V _{out} = 1.2 V, V _{in} = 5 V, C _{ref} = 2.2 μF, C _{out} = 3 × 22 μF		70		dB
Continuous Output Current	I _{out}	T _A = 23 °C	4.0			A
		T _A = -40 °C to 105 °C	1			A
Shutdown Current	I _{SD}	V _{en} = 0 V, V _{in} = 5.5 V, No load		30	70	μA
Peak Current Limit	I _{LPK,LIM}			7.0		A
Efficiency	η	I _{out} = 4 A, V _{out} = 1.2 V		84.8	88.2	%
		I _{out} = 1 A, V _{out} = 1.2 V		83.5	91.2	%
I ² C Clock Frequency	f _{I2C}		10		1000	kHz
Switching Frequency	f _{sw}		5.4	6	6.6	MHz
Synchronization Range	f _{SYNC}		4		8	MHz

²Exposing the device to conditions beyond the “Absolute maximum ratings” list may affect the reliability of the device or cause permanent damage.

³“TYP” values apply for typical conditions, “Min” and “Max” values apply for worst case conditions; unless specified otherwise.